

COMMENTS BY RUSSELL BIOMASS ON MANOMET STUDY AND REVISED REGULATIONS

Russell Biomass is submitting extensive comments on the Manomet study and on the related July 7 letter from Secretary Bowles to the Department of Energy Resources (DOER). In these comments we have repeated certain arguments in different sections because of the interdependency of one requirement to another, and to preclude DOER from having to move back and forth in the document in order to follow our arguments.

In the first instance we want to acknowledge the following:

- 1 Through the Manomet study the Massachusetts (MA) Executive Office of Energy and Environmental Affairs (EOEEA) has accomplished some ground-breaking work. It has addressed for the first time the issue of what life cycle of benefits is appropriate in setting greenhouse gas (GHG) policy. In so doing it has introduced into the policy debate for the first time the tradeoff between short-term and long-term GHG benefits. This is particularly relevant to the setting of specific short-term vs. long-term goals for GHG reduction programs.
- 2 EOEEA had a difficult task to carry out in negotiating with the primary biomass opponent organization the terms of the July 7, 2010 letter to DOER. At risk was the ceding (had the letter not been agreed to) MA GHG and energy policy to a November ballot question that would have precluded all-electric biomass from qualifying for the MA RPS program. This would have been a poor way to accomplish GHG and energy policy. To avoid this, the Secretary and DOER had to effect a compromise that was acceptable to the opponents. They succeeded. Inevitably, this produced some provisions that conflicted with some desirable energy policy objectives and, perhaps more legally important, specific provisions of the RPS legislation.

It is important for DOER to note that virtually all of our conclusions, references and suggestions are based on the Manomet study results, neutral engineering sources and other technical sources. We have tried hard to avoid introducing selective and unsupported information.

A summary of the comments, supported in detail in the subsequent body, is presented below. This summary is arranged in the order the comments appear in the document, and not in order of importance. Reference page numbers are shown.

- **Our plain language reading of the Renewable Portfolio Standards (RPS) legislation raises the question as to whether the revised RPS regulations can require a biomass project to produce thermal energy or achieve a specific minimum efficiency (page 3)**
- **All-electric biomass plants with (a) an optimal all-electric efficiency and (b) waste wood as its dominant (GHG-benefits-oriented) source of wood supply can contribute more in absolute terms to the Global Warming Solutions Act (GWSA) goals and the GHG objective of the July 7 Bowles letter than forest-biomass-fueled Combined Heat and Power (CHP) plants (page 5)**
- **The Manomet study results show that an all-electric or equally large CHP biomass plant fueled by tops and limbs and other waste wood sources will meet the 20-year life cycle “50 percent less than gas-fired” requirement in the Bowles July 7 letter, but no CHP biomass plant using forest biomass will meet this requirement. (page 5)**
- **A meaningful (real-world) fossil-fired power plant mix should be used as the GHG life cycle benefit reference. (page 6)**

- To maximize long-term GHG benefits the life cycle analysis should use a single year vs. a cumulative carbon dividend. (page 7)
- For a 20-year life cycle analysis none of the Manomet CHP thermal displacement harvest scenarios shows a result 50 percent better than any fossil technology – even using a single year benefits test. (page 7)
- The 20-year life cycle requirement will not allow biomass plants of any type using forest biomass as a fuel to qualify for the RPS program benefits, whereas all-electric plants and large CHP plants capable of burning the full mix of non-forest biomass (waste wood) will likely qualify. (page 8)
- Excluding CHP and all-electric projects with GHG reduction benefits from year 21 onward would result in a decrease in the year 2050 GHG benefits. (page 8)
- There is nothing wrong with setting demanding interim goals along the way to the 2050 GWSA goal as long as they don't negatively affect the GHG reduction to be achieved by 2050. (page 9)
- The methodology for calculating a biomass plant GHG impact must use meaningful assumptions for the project wood supply area involved. (page 10)
- Because a substantial portion of a large biomass plant wood supply is non-forest waste wood, and because of the 21-times-greater impact of methane emissions compared to CO₂, the methane impacts are critical to estimate for the appropriate portion of waste wood that would be land-filled or would decay in piles, thus creating methane from the oxygen-deprived wood waste. (page 10)
- The revised regulations must be analytically and legally defensible vis-à-vis the GWSA goals and MA RPS legal requirements. (page 10)
- A blind application of a 60% efficiency requirement will rule out many CHP projects that don't have a 24/7 thermal use across all seasons. For example, no CHP seasonal space heating plant would qualify. (page 11)
- The most important aspect of the efficiency requirement of the regulations is that it must not rule out CHP and other projects that can otherwise achieve the GHG goals of the GWSA – i.e., the dominant policy objective of the revised regulations. (page 12)
- Use of non-forest biomass for fuel has the greatest potential for biomass GHG benefits. (page 13)
- If forced to leave 50 percent of the tops and limbs throughout the forest where the trees are cut down, the removal of any tops and limbs (which is clearly desirable) or even the logging itself could become uneconomic. (page 14)
- The DOER regulations should allow for DCR, DEP or the MA state forester review and input on the forest biomass sources proposed by an RPS applicant. (page 14)
- The only workable solution to issuing meaningful RPS regulations for the range of different CHP and other technologies is to put the burden of demonstrating the GHG benefit numbers – PER A

VERIFIABLE-DATA-SUPPORTED ANALYTIC METHODOLOGY SPECIFIED BY DOER – onto the CHP or all-electric biomass project requesting RPS qualification from DOER. (page 14)

- **To eliminate any potential controversy over the methane emissions assumption (which must be set at some value other than zero) DOER may want to specify a minimum default percent methane emissions amount unless the RPS applicant can clearly demonstrate otherwise. (page 15)**
- **Failure to properly incorporate an accurate methane impact assumption into the GHG benefits analysis will substantially underestimate the life cycle benefits of waste-wood-fired biomass plants and the GHG reductions needed to achieve the GWSA goal. (page 15)**

Background

DOER must prepare revised regulations related to the Manomet forest biomass sustainability study. These regulations must be consistent with the legal requirements of the 2008 MA GWSA and the MA RPS program. DOER must also address the requirements of the July 7, 2010 letter from Secretary Ian Bowles that highlights the need to reflect the Manomet study results in implementing the GWSA.

The Manomet study, completed in June 2010, focused on the (a) sustainability of combusting forest biomass for generating energy in MA and (b) the greenhouse gas (GHG) and carbon policy impacts of doing so. Subsequently, during the public comment period, on July 7 Secretary Ian Bowles issued a letter to the Department of Energy Resources (DOER) with specific requirements to be reflected in the revised RPS regulations based on the Manomet study. Because of the need for a compromise with biomass opponents by July 7 at the latest, in order to keep a highly undesirable anti-biomass question off the November election ballot Secretary Bowles and DOER had to issue the July 7 letter before the public comment period was completed. However, the letter refers to the GWSA and the Manomet study and makes clear to DOER that:

- **New science should guide the new regulations** (*DOER's methodology will be key to this*)
- **All questions have not been answered** (*We identify several that DOER must address*)
- **DOER must observe a robust public process** (*That is, valid public comments should matter*)

In our comments below we refer to the Manomet study, the July 7 letter and legal requirements of the 2008 GWSA and the MA RPS program as they relate to the RPS qualification requirements to be addressed by the revised regulations DOER will submit.

Legal and Technical Frame of Reference

In this section we provide a legal and technical framework for the comments and suggestions in the subsequent sections.

Legal Framework

After reviewing Secretary Bowles' July 7 letter we tried to understand the plain language of the RPS and 2008 GWSA legislation. While we have not done a legal analysis per se we outline the following points for DOER to check and consider. As we read it from a layman's viewpoint the RPS language does the following:

- The RPS requires inclusion of biomass electric generating facilities. **We do not see a requirement that biomass facilities achieve a specific efficiency or produce thermal energy outputs such as**

steam or hot water. Can the DOER regulations require this if the legislation itself does not? This point has to do with our concern that the July 7 letter language in part 1) could be interpreted to require a minimum numerical efficiency or some thermal energy output. Other specific language has to do with low emission advanced technology, a requirement that DOER has previously verified for all-electric biomass.

- Note: DOER should note that it is much harder, if not economically prohibitive, for a small to medium size CHP plant to employ the equipment needed to achieve the very low NOx, PM and other emissions limits that large biomass plants have been required to achieve. That is, the lowest emission advanced biomass technology will be the large all-electric and large CHP plants.

Having stated the above, we have no objection to demonstrating the maximum practical efficiency for an all-electric plant.

- The RPS articulates the purpose (and legislative intent) of increasing the amount of renewable energy, specifically including biomass power. The July 7 letter requirements, if interpreted to exclude any biomass power technology, would appear to in conflict with the purpose of the RPS.
- While we don't readily see a conflict between the July 7 letter and the GWSA language we think the 20-year life cycle benefit requirement will impede the purpose of the GWSA in achieving the maximum GHG reduction by 2050.
- We have a clear concern that biomass opponents or other parties may legally challenge the revised regulations no matter how they are written. If the effect of this is to delay their implementation and to extend the RPS biomass suspension indefinitely this will have the effect of terminating all biomass projects under development and, no doubt, delaying any initiation of new CHP plant development, both of which would impede the goals of the RPS program. Accordingly, if this occurs, we recommend that DOER revoke its biomass suspension until the revised regulations legal issues are resolved. Because the prior regulations (currently suspended) were not legally challenged there should be no legal issue putting them back in effect until there are new regulations to replace them.

In summary, DOER must meet the stated intent of the July 7 letter (achieve GHG benefits within sustainable wood supply limits) without violating the legal force of the legislation in place. The legislature will have an obligation to look carefully at this in its review of the proposed regulations when submitted by DOER.

Technical Reference Information

In framing its revised regulations it is vital that DOER recognize the efficiency variations and fuel supply differences between the types of CHP plants that will likely develop and larger all-electric biomass plants.

- Most small to medium size CHP plants must use more completely chipped and uniform size green wood chips, much of them from forest biomass (the highest cost source of biomass fuel) because the much simpler CHP fuel handling systems cannot accommodate such waste wood supplies as sawmill residue (stringy and higher-ash bark and sawdust), stumps (high dirt and ash content), forest fire residue, waste pallets (ground up, not chipped) and other non-uniform fuel components. For an all-electric plant and an equally large CHP plant these waste wood supplies lower the cost and they also allow for increased plant efficiency due to the lower average moisture content.
- Many smaller CHP plants would have no fuel pile mixing and work-over prior to boiler in-feed, no hogger to break up larger-than-spec pieces and stringy bark, no capability to uniformly mix fine grain sawdust, and no pre-boiler mixing mechanism to assure a constant moisture content. One difference as a result of its simpler fuel handling system is a greater variability in boiler fuel moisture content for these CHP plants, as opposed to the relatively steady moisture content for a large all-electric and CHP plant – with a resulting lower electric generation efficiency. Also,

with a greater portion of forest biomass for its fuel, the GHG benefits will be less than that of a waste-wood-dominant fuel supply (see the Manomet carbon numbers for forest biomass compared to tops and limbs). For a smaller CHP plant all this will tend to lower the GHG benefits and will produce a greater fuel cost than for a large biomass plant with its waste-wood fuel supply mix. This, in turn, will make the qualification and receipt of RECs for smaller CHP plants critical to their economic viability. It is important that the efficiency requirement in the revised regulations recognize the range of efficiencies and fuel mix characteristics that CHP plants will have.

- There has been no assessment of the total energy generation potential and total GHG benefits from likely CHP plants, but it is unlikely that this could come anywhere close to the potential of larger all-electric biomass plants fueled mainly by waste wood. In terms of meeting any GHG benefit goals DOER should consider this.
- Considering the above, **all-electric biomass plants with (a) an optimal all-electric efficiency and (b) waste wood as its dominant (GHG-benefits-oriented) source of wood supply can contribute more in absolute terms to the 2008 GWSA goal and the GHG objective of the July 7 Bowles letter than green-wood-chip-fueled CHP plants** because:
 - o The CHP forest biomass and other green wood chip supplies will result in a much lower carbon dividend than that for an all-electric waste wood supply
 - o Therefore, the GHG benefits from the total output of larger all-electric plants will likely be greater than the GHG benefits from the total output of CHP plants (not unlike the all-electric/CHP mix in NH)

With this in mind we now provide comments on key requirements DOER must consider in framing the revised regulations.

Minimum GHG Benefit Requirement

The Manomet study results show that an all-electric or equally large CHP biomass plant fueled by tops and limbs and other waste wood sources will meet the 20-year life cycle “50 percent less than gas-fired” requirement in the Bowles July 7 letter, but no CHP biomass plant using forest biomass will meet this requirement. All-electric plants and some very large CHP plants with a fuel handling system that can process the full range of waste wood could meet this test. We elaborate on this conclusion in detail later in these comments. Many CHP plants of different sizes might have a steady electric power demand and with an electric power efficiency in the 15-20 percent range, but a highly variable seasonal (4-5 month) space heating efficiency - a thermal-only efficiency that varies from 0 to 40 percent during the year, for a combined annual average efficiency of 30-45 percent. (Note: The electrical efficiency portion of a CHP plant is typically less than that of an all-electric plant for various technical reasons, including the higher pressure (earlier thermodynamic) withdrawal of steam for thermal use and a higher-moisture green wood chip fuel compared to the largely waste-wood fuel mix of an all-electric plant.) While this combined efficiency may be higher than the 25 percent efficiency of an all-electric plant, the expected use by CHP plants of forest biomass and other green wood chips would produce lesser GHG benefits than a largely waste-wood-fired all-electric plant. And there will be a meaningful portion of community and other CHP plants whose thermal **and** electrical output and efficiency will vary, with an overall annual efficiency in some cases of no more than a steady 24/7 all-electric plant. (There is plenty of technical reference information for this.) So, the “50 percent less than gas-fired” requirement will be harder for many CHP plants to meet than for all-electric biomass plants. In summary, there is a real danger, regardless of whether all-electric plants are ruled out by fiat, that “much of the CHP baby will be thrown out with the bathwater.”

The above conclusions are further addressed in our later comments. We outline below our arguments and recommendations for DOER’s consideration in framing the revised regulations.

- To achieve the best GHG and energy policy results, as a minimum DOER should **use a meaningful (real-world) fossil-fired power plant mix as the GHG benefit reference.** Using a gas-fired plant (which for only a certain number of hours in the year is correct) as the reference does not accurately reflect this.
 - To start with, the GHG impact fossil-fired reference should not prohibit any biomass technology whose GHG life cycle benefits are better than the worst (coal) fossil-fired GHG technology. In terms of GHG and broader energy/environmental policy why do this?
 - Under the July 7 letter requirements, biomass plants whose GHG impacts are better than coal but worse than gas-fired would be excluded. There is no GHG or energy policy rationale for this, and this flies in the face of EOEEA's environmental policy mission. (See the attached list of coal use hazards.)
 - No biomass party, including any biomass opponent, argues that coal is preferable to biomass as a power supply if the biomass supply will help meet the 2050 GWSA goals.
 - Manomet provides data for the potential benefits of biomass vs. different fossil displacement scenarios by 2050, and the July 7 letter calls for the revised regulations to reflect the Manomet findings.
 - In particular, the Manomet study shows immense benefits vs. coal for a biomass plant using waste wood (see Manomet Tops and Limbs carbon benefit numbers).
 - Even though coal should be used as the GHG benefits reference, if it is not used there is no reason not to use the actual ISO fuel displacement mix, which is only partly gas-fired.
 - Finally, even if gas-fired power is used as the reference there is no GHG or energy policy rationale for prohibiting a CHP or all-electric biomass plant whose GHG impacts are better than gas by any margin. Setting a requirement for any biomass plant to be any minimum percent better than a gas-fired plant would rule out CHP and all-electric biomass plants that could produce net benefits before 2050 and would, therefore, contribute to the 2050 GWSA GHG reduction goals. To prohibit such CHP or other biomass plants would reduce the 2050 GHG benefits, a result counter to the purpose of the GWSA.
 - Specifically, this would rule out CHP or all-electric plants that are 1-49% better than gas within 20 years - plants that would produce a major GWSA benefit by 2050.
 - This poses a conflict with the goal of the GWSA. Notably, the only biomass technologies that can meet the short-term (2020) goal specified in the GWSA are a large all-electric plant and an equally large CHP plant that can utilize almost 100 percent waste wood. Using the single year life cycle test for the tops and limbs carbon recovery results from Manomet (which reflected no other waste wood source nor methane emissions benefit) the carbon debt payoff is less than 10 years.
- **To maximize long-term GHG benefits the life cycle analysis should use a single year vs. a cumulative carbon dividend.** We explain this below. As reference we cite Manomet's finding from page 110 of their study:

“All biomass technologies – even biomass compared to natural gas electric – look favorable when biomass “wastewood” is compared to fossil fuel alternatives.”

- Analysis of the Manomet carbon debt and recovery data for tops and limbs (i.e., waste wood) confirms the above (see Exhibit 6-7 and Exhibit 6-12 tops and limbs data). In fact, the life cycle period by which waste wood biomass becomes 50 percent better than gas-fired power is less than 20 years, with a carbon debt payoff period of less than 10 years. (Compare this finding to the Exhibit 6-13 findings for forest biomass as a fuel.)
- The question is whether a single year or a 20-year cumulative carbon dividend analysis should be used to determine the GHG benefits of a biomass technology against the fossil-fired reference DOER chooses to use in the revised regulations. Importantly, Russell Biomass’ analysis of 100 percent use of waste wood as the fuel supply and realistic methane emissions assumptions indicates that an all-electric plant or a large CHP plant capable of using all waste wood sources will satisfy the cumulative carbon dividend requirement within 20 years. But we don’t think the cumulative carbon dividend is the appropriate measure, for the following reasons (we specifically comment on the 20-year life cycle later):
 - Each year’s carbon debt and subsequent carbon recovery period produce the same GHG life cycle benefits over a 20-year period. The fact that, in a 20-year life cycle benefits analysis, year 20 produces a carbon debt with no recovery does not make that year less valuable in terms of long-term GWSA benefits. Year 20 is just as valuable long-term as year 1. It’s just that the year 20 recovery benefits were arbitrarily eliminated from the fixed year 1-20 analysis. To make the point conceptually, if each year were a ”separate project” that operated for only 1 year then each “project” would qualify. In terms of GHG policy there should be no difference in the way the single long-term project and the 20 “one-year projects” are addressed by the regulations because the GHG benefits and impacts are the same. This is an illogical result. Adopting the single year measure for any life cycle time frame would resolve this.
 - More small to medium size CHP projects would fail to qualify, e.g., lower efficiency space heating projects with green wood chips as a fuel. As explained elsewhere, these CHP plants would not provide the same level of GHG benefits as large plants with a waste wood supply. And it is the smaller size, space heating CHP plants that many communities would likely require (and that many opponents of large biomass plants argue should be stimulated). For reference, DOER should note the experience and arguments for small community plants that the Biomass Energy Resource Center provided as part of the Manomet study.
- To appreciate the above arguments it is instructive - in fact, crucial - for DOER to note the carbon dividend results of the Manomet study on page 112 (attached):
 - Of the 12 thermal displacement harvest scenarios shown in Exhibit 6-13 only 4 show a carbon dividend greater than 50 percent by the year 2050 (a 40-year test). These results are for a single year GHG benefit analysis. **For a 20-year life cycle analysis none of the CHP thermal displacement harvest scenarios would show a result 50 percent better than any fossil technology.** Thus, no Manomet scenario will meet the July 7 letter test.
 - As one would expect the cumulative year analysis is much more negative. See Exhibit 6-14. None of the technologies meet the 50-percent test even for a 40-year analysis. The greatest carbon dividend is 34 percent. The results will clearly be worse for a 20-year analysis.

In summary, it appears likely that many desirable CHP plants would fail even a single-year life cycle GHG benefits test, even if they have a high efficiency. This is even more the case for the cumulative year test. Not only does this

defeat the intent of energy policy in general, as mentioned above it also results in an illogical GHG benefit result compared to a single year test.

- A major issue exists with respect to the 20-year life cycle requirement set out in the Bowles July 7 letter. Based on the Manomet results **the 20-year life cycle requirement will not likely allow biomass plants of any type using forest biomass as a fuel to qualify for the RPS program benefits, whereas all-electric and large CHP plants capable of burning the full mix of waste wood will likely qualify** (see the earlier discussion of using a single year vs. cumulative GHG carbon dividend test). This finding has to do with the likely different fuel mixes (see later Wood Fuel Sources section) for CHP vs. large all-electric plants, variable thermal demand (with efficiency impacts) for many CHP plants, and lower CHP electrical generation efficiency. This will likely be true even with a less demanding coal or fossil fuel mix as a reference rather than gas-fired power - see the Manomet results on page 112 (attached) of the study. Because of their less sophisticated fuel handling design, most CHP plants will tend to burn only green wood chips, much of it from forest biomass, with its more limited GHG benefits than waste wood (with its lower moisture content and partial methane decay emissions). Further, even for a CHP plant with a strong thermal demand year-round, the Manomet results show that for 4 of 6 oil thermal scenarios over 40 years (and all scenarios over 20 years) there will not be a sufficient carbon dividend to meet the 20-year requirement. In contrast, a 25-percent efficient all-electric and an equally large CHP plant using 100 percent waste wood will qualify - as shown by the Manomet study tops and limbs carbon debt and recovery results, which Manomet acknowledges does not reflect the full GHG benefits of non-forest biomass.

There are other issues in using the 20-year life cycle requirement:

- **Excluding CHP and all-electric projects with GHG benefits from year 21 onward would result in a decrease in the year 2050 GHG benefits that would otherwise occur with a longer life cycle test.**
- The 20-year lifetime requirement is not supported by the policy-related discussions in the Manomet study. The study goes to great length to point out that GHG and energy policy needs call for a careful review of the time frame for achieving GHG benefits. There is significance in the fact that the key result tables in the study present results for the years 2050 and 2100. The July 7 letter explicitly charges DOER to reflect the Manomet study results in the revised regulations.
- To the extent the July 7 letter was intended to support the short-term goals of the GWSA the 20-year lifetime (year 2030) does not match the year 2020 (10-year) short-term target year goal of the GWSA. And a 10-year life cycle test is too short for most biomass technologies, although the Manomet results show that a large all-electric or CHP biomass plant fueled 100 percent by waste wood will have a carbon debt payoff of less than 10 years using a single year life cycle test.
- More broadly, the 20-year life cycle is inconsistent with many well-regarded GHG impact and policy analyses, including the 2008 Pacific Institute study, the US National Renewable Energy Lab (NREL) study, the European Union study and the Kyoto accord. These analyses used from 40 to 100 years for their GHG impact goal target dates. The distinct danger in using an overly short, 20-year life cycle – exacerbated by a gas-fired benefit reference - is that a substantial amount of biomass project GHG benefits that would occur during years 20 to 100 would be lost.

Note: It is important to understand the purpose of the GWSA 2050 target year, or any other target year for GHG goals. They are all intended to reduce GHG emissions long term. The challenge to reduce

existing and new GHG emissions over time will continue far into the future – no one disputes this. To achieve the long-term goal, specific target years are set so that progress can be measured. But no short-term or interim year goal should be used to reduce benefits that could contribute later to longer-term reductions unless the short-term adverse impact has been shown to outweigh the longer-term impact. No one has shown or even argued that this will be the case within 20 years, and there is no information on the legislative intent behind the GWSA that suggests this. Therefore, the loss of year 21 onward is contrary to good long-term GHG policy, and will cause a worse impact long term. Stated in other words, the GHG reduction battle is not over in 20 or even 40 years (per NREL, Kyoto et al), and a way should be found to stimulate all biomass projects that can contribute long term.

It is instructive to note the July 20, 2010 letter to the Federal EPA from over 100 respected natural resource and other scientists. In fact, there is little difference between their July 20 letter and the Manomet study in terms of forest biomass considerations (Manomet's focus). The scientists acknowledge that (1) biomass must be re-grown at the same rate that it is consumed (which is the case in the northeast US) and (2) that sustainable forest management is required. With their broader letter scope than the Manomet study the scientists articulate the importance and relevance of:

- Natural tree mortality – that is, in the long term all trees die and release their stored carbon into the atmosphere whether or not biomass is used as an energy source
- Using a proper forest re-growth rate
- Accounting for methane emissions from natural decomposition

The single substantive difference between the scientists' argument and the Bowles July 7 letter is the 20-year life cycle limit vs. a longer-term time frame for evaluating GHG benefits. The scientists - and most other entities evaluating the GHG issue - argue for a longer term time frame. The scientists' position is that, in the long term, all CO₂ now in the forests will be released. With a long-term life cycle limit all possible biomass supplies would be used for energy generation.

Closer to home, the state of Massachusetts in 2008 set a 42-year target (2050) for the goal in the GWSA, but even in that legislation there is no suggestion that reductions beyond that time frame are not important and needed, nor is there any statement that near-term reductions are so critical that the long-term benefits should be sacrificed. The 20-year life cycle qualification requirement of biomass projects would interfere with this.

It is not a coincidence that Manomet, with DOER's agreement, provided major summary tables showing results for 2050 (40 years) and 2100 (90 years).

While the 20-year requirement was a compromise term in order to keep the anti-biomass question off the November ballot, DOER has the responsibility to, and can justifiably use, the room in the agreed-upon language (the "four corners of the agreement") of the July 7 letter to maximize the GWSA GHG policy objectives in its revised regulations.

Given the above, **there is nothing wrong with setting demanding interim goals along the way to the 2050 GWSA goal as long as they don't negatively affect the GHG reduction that would be achieved by 2050.** So how can the 20-year life cycle agreement be honored in a constructive way? One constructive option is:

- Require a biomass plant to show a contribution (i.e., a reduction) toward the 2050 GHG goal (whatever fossil-fired reference is used) but limit RPS qualification to 20 years if the biomass plant (CHP or all-electric) (1) contributes any reduction to the GHG goal by 2050 but (2) does not produce any reduction for the 20-year life cycle. In this case the 20-year life cycle limits the RPS qualification long term without a negative effect on the GWSA goal. Thus, the July 7 letter intent for RPS qualification would be addressed.

- **The methodology for calculating a biomass plant GHG impact must use meaningful or actual assumptions for the project wood supply area involved** because the mix of wood species (hardwoods vs. softwoods) varies in different areas of the northeast. These assumptions include:

- *Percent stored carbon vs. emitted carbon* (the July 7 letter refers to this)
- *Waste wood decay rate* (Manomet indicates most occurs within 10 years)
- *Methane emissions from wood allowed to decay if not burned* – THIS IS NOT ZERO
 - Must assume some portion is land-filled (reflects reality)
 - Must assume some piles left around will generate some methane
 - Must assume some small levels of methane emissions occur from the remainder

Without these assumptions a biomass plant's GHG benefits will be clearly underestimated.

- Tree mortality time frame (all trees die and decay with CO₂ and other emissions)
- Forest re-growth rate (see actual MA and other state forest data from US Forest Service)
 - This estimate appears low for Massachusetts in the Manomet study

Based on comments to date on the Manomet study there appears to be reasons to refine some of the above numbers used in the Manomet study (e.g., using actual available state forest re-growth data from the US Forest Service). Further, because Manomet did not focus on non-forest biomass (waste wood), and the waste wood numbers they did estimate were for forest logging tops and limbs only, the impact of methane emissions from non-forest waste wood were not addressed. **Because a substantial portion of a large biomass plant wood supply is non-forest waste wood, and because of the 21-times-greater impact of methane compared to CO₂, the methane impacts are critical to estimate for the appropriate portion of waste wood that would be land-filled or would decay in piles, thus creating methane from the oxygen-deprived wood waste.** There are estimates of this in the Pacific Institute and NREL GHG studies.

- *The manner in which the revised DOER regulations treat the above assumptions, the 20-year life cycle guideline, the fossil-fired power GHG benefit reference and the definition of waste wood will undergo great scrutiny by impacted biomass industry parties, other state and Federal governmental officials, the greater scientific community and the MA state legislature. **The revised regulations must be analytically and legally defensible vis-à-vis the GWSA goals and MA RPS legal requirements.*** The Manomet study is referenced in the Bowles July 7 letter as the major reason for issuing that letter. The Manomet study provides methodologies and a range of data that DOER can justifiably use, including the GHG characteristics of waste wood as a fuel. The July 7 letter also makes clear the importance of the goals of the GWSA. In particular, how the July 7 letter requirements are dealt with in the revised regulations will receive special scrutiny because that letter was issued before the public comment period was

completed, and it will be subject to the criticism that it did not properly take into account the public comments relevant to its requirements. ***But the point that should not be lost in all of this is that the expected real world impacts of a specific project should be accounted for in order to maximize the long-term GWSA benefits.***

Biomass Project Efficiency Requirement

It only makes sense to interpret the July 7 Bowles provisions to achieve *maximum practical efficiency* with a CHP or *comparable technology* in the best possible way, supported by the Manomet study findings, to achieve the GHG goals of the GWSA. And it is essential to examine the fuel use constraints associated with different technologies – because those constraints (e.g., for small CHP plants compared to large all-electric and CHP plants) affect the GHG benefits that each technology can achieve. (See the technical reference information provided in the Framework section of this submittal.) **The intent of the words “comparable technology” should be to allow for any biomass technology that can support the policy goal of achieving GHG benefits.** That is, the whole focus of the July 7 letter is on GHG benefits. To exclude any biomass technology that can meet the GHG benefit requirement is not appropriate. The parameters of each technology, including fuel use characteristics and constraints, that bear on the potential for achieving GHG benefits must be accounted for. It was insightful for the July 7 letter requirements to allow for a difference in efficiencies for different technologies, and not to restrict the type of technology per se.

As long as a focus on the resulting GHG benefits is retained:

- **There is no GHG benefit logic in or a need for a requirement per se that arbitrarily requires (1) some thermal use (although it’s always desirable) or (2) a minimum 60 percent efficiency no matter what.** Otherwise:
 - A worthwhile CHP plant may not meet the 60-percent minimum even if it meets the minimum GHG benefit requirement, and thus be denied the RECs needed to make it economic
 - An all-electric plant using mostly waste wood may meet the minimum GHG benefit requirement yet be denied the RECs needed to make it economic

Note: See the discussion at the beginning of the minimum GHG benefits section on CHP and all-electric plant efficiencies.

 - The solution is to make the GHG benefit requirement the dominant guiding requirement so that the GHG benefit intent of July 7 letter is met.
- **A blind application of a 60% efficiency requirement will rule out many CHP projects that don’t have a 24/7 thermal use across all seasons. For example, no CHP seasonal space heating plant would qualify.**
 - It makes no sense to prohibit a project that meets the GHG goals on the basis that its efficiency would be 59 percent or lower. Further, such a requirement may violate the intent of the GWSA.
 - Note: We think the 60-percent target came from an optimal gas-fired CHP plant. We know of almost no boiler-steam turbine CHP applications that have a 60-percent efficiency. This is important to check.
- Beyond the above argument there is a practical aspect of specifying a minimum efficiency: The operating performance of a plant may not achieve its design parameters, such that a 60 percent or any other quantitative design

minimum may not be achieved in practice. For a CHP plant the variability of its thermal demand, particularly seasonal space heating variations, will automatically cause its operating efficiency to vary. An all-electric plant would have a much lesser concern about failing to meet a performance spec because of the much greater assurance of performance associated with its design and financing, and its 24/7 electrical output independent of seasonal factors. Further, an all-electric plant periodically measures its efficiency, and can easily provide this data, whereas many CHP plants would not. Even if there were a mechanism to monitor a CHP plant efficiency there likely would still be subsequent RPS qualification issues during operations related to its variable output operation. Some related suggestions for DOER provisions in the regulations are:

- It will be far better to avoid specifying a minimum efficiency but rather require an RPS applicant to justify an estimated efficiency based on a valid engineering analysis (similar to that required by the DEP air permit process). The simple July 7 letter guidance of “maximum practical efficiency” is appropriate so that any biomass plant, including low-efficiency CHP plants, are eligible if they meet the GHG benefit test.
- For any project that chooses to do so a project could receive automatic RPS qualification if he will accept the requirements to demonstrate a minimum percent efficiency with a valid engineering study and meet the GHG benefit life cycle requirement using forest biomass. (Is a 60% minimum too high to stimulate CHP?)
- An all-electric biomass project must demonstrate its optimal efficiency with a valid engineering design study. This efficiency will vary by size, and will approximate 25 percent for a plant as large as 50 MW.

The most important aspect of the efficiency requirement of the regulations is that it must not preclude CHP and other projects that can otherwise achieve the GHG goals of the GWSA – i.e., the dominant policy objective of the revised regulations. For emphasis, we must point out that the November ballot question proposed by the state biomass opponents focused on a *GHG impact* limit. It is consistent with that focus – and fair to all parties - to assure that the efficiency requirement not preclude a related CHP or all-electric plant *GHG benefit* that would otherwise occur.

Wood Fuel Sources

For any applicant in or out of Massachusetts it is critical to use expected actual wood supply numbers – forest and non-forest biomass. These will bear on the project efficiency and GHG benefit calculations.

- An overall resource study should be provided by the applicant
- Specific suppliers sufficient to supply over half the required fuel must be identified in the application, and the list updated at construction start
- A small (5 MW or less?) CHP or electric plant could be exempted from demonstrating his fuel supply by assuming a fuel supply assumed to be all forest biomass. However, he would still have to meet the life cycle and efficiency requirements of the regulations.
- A requirement can be set to require verification of the sources during operation - in the initial wood supply contracts and verified with a delivery invoice for each delivery (subject to legal penalty if incorrect)
- Clean (not treated or contaminated) waste wood sources should be defined as including:
 - Tops and limbs from logging and woodlands management

- Dozens of tree service companies that trim power lines, serving private residences, commercial properties, and the like
- Developers of residential, commercial and industrial facilities that clear land
- Sawmill residue – bark, chips and sawdust
- Stumps
- Waste pallets
- Municipal wood yards not co-located with any treated wood facility
- Annual tree storm damage
- Annual diseased tree removals
- Periodic forest fire damage
- Low-grade trees cut down by woodlands owners for forest management purposes

Note: The classification of these low-grade trees as (1) cut only for biomass plant fuel or (2) waste wood is an issue. The question is whether the woodlands owner wants the trees removed to support his overall woodlands growth and health or whether he simply cuts them for economic reasons to sell as biomass fuel. Since he always sells them for a give-away price of \$1-3 per ton it is not the economic reason but rather the woodlands growth and health reason that woodlands owners cut such trees.

The DOER regulations can differentiate this in the GHG impact methodology by requiring certification (if it is to be counted as waste wood) by the wood fuel supplier that he paid \$3 or less for the chips. This price is a far cry from the much higher price the woodlands owner receives for wood sold as pulp wood – i.e., an economic rationale to cut the trees down.

Note: Previous MA and CT resource studies indicate a collective volume of 2-4 million tons per year in southern New England for the above sources. This includes a 2002 DOER study.

- **Use of non-forest biomass for fuel has the greatest potential for biomass GHG benefits.** Not to include all of the above sources as eligible biomass plant sources would be counter to MA environmental policy that discourages wood from going to landfills or being dumped in vacant fields or elsewhere. Furthermore, the tops and limbs tend to stay on the forest ground and decay with emissions that are almost all CO₂. But other sources of waste wood go in part to landfills, and some other sources (often chipped up and discarded where convenient) will decay in piles. The wood waste below the surface becomes oxygen-deprived and emits methane along with CO₂. (In fact, the remaining waste wood emits some small amounts of methane.) This critical need for the regulations to account for different fuel supply mixes for different projects requires that an RPS qualification applicant have the burden of documenting his plant design, fuel mix, electrical and thermal demand and operating output. DOER cannot provide specific regulations that cover all cases.

- The wood supply to a small CHP plant will likely be limited mainly to green wood chips from the first four sources above to ensure a uniform delivered wood chip size and quality. For a large biomass plant the variation in size, moisture content, ash/dirt content, bark and sawdust content and other characteristics of the remaining sources can be processed into a uniform boiler input quality by its more sophisticated fuel receipt, handling and processing system.

The fourth requirement in the July 7 Bowles letter regarding the requirement for logging operations to leave at least 50 percent of the tops and limbs in the forest will present a major cost problem for legitimate loggers, who typically cut down and skid the tree to a landing. Usually, much less than half the residues are left behind. Manomet's "50 percent" assertion in Appendix 3-B, page 134, is incorrect. **If forced to leave 50 percent of the tops and limbs throughout the forest where the trees are cut down, the removal of any tops and limbs (which is clearly desirable) or even the logging itself could become uneconomic.** Note: most logging in Massachusetts is on a selective cutting basis, generally removing less than half of the standing volume on the managed property. Under this partial cut it makes no sense to leave half of the tops and limbs in the woods from such a harvest out of a desire to protect soil nutrients because the removal impact is so tiny.

Note: Russell Biomass acknowledges that the "leave at least 50-percent" requirement may simply reflect the political accommodation necessary in the July 7 letter in order to preclude the November ballot question. While the cost constraint this imposes on logging operations will not pose a limit on the Russell Biomass fuel supply it may impact forest management in a negative way that is not good for the state woodlands – that is, it may reduce the economic potential for logging some properties by limiting their economics.

Forest health and sustainability were important parameters of the Manomet study and the forest management impacts of the revised regulations will be important. Incorporating the right expertise into the process is key. Our comments are:

- **As directed by the July 7 letter DOER regulations should allow for a DCR and DEP (or MA state forester?) review and input on the sustainability of forest biomass sources proposed by an RPS applicant.** This will preclude any internal state executive branch conflict on forest management.
- Out-of-state biomass applicants will have to submit sufficient information for DOER and the MA DCR to adequately review compliance with MA DOER regulations. It is essential that out-of-state projects be held to the same requirements as MA plants. To do otherwise would put MA projects at a competitive disadvantage vis-à-vis out-of-state projects (a reverse "TransCanada issue").

In fairness to DOER the time allowed by the Bowles July 7 letter to develop the revised regulations is not at all sufficient to support the development of revised regulations by the target date. **The only workable solution to issuing meaningful regulations is to put the burden of demonstrating the GHG benefit numbers – PER A VERIFIABLE-DATA-SUPPORTED ANALYTIC METHODOLOGY SPECIFIED BY DOER – onto any CHP or all-electric biomass project requesting RPS qualification from DOER.** Manomet has provided data and assumptions that might be used as default assumptions in an applicant's submittal to DOER, while allowing for an applicant to propose different ones. The right to propose (and justify) different assumptions is critical because project locations, fuel mixes and design characteristics will cause the assumptions to vary by project – although the applicant could always choose to accept what would be default assumptions in the regulations methodology. Further, similar to other state permits DOER can place conditions into the permits for requirements relevant to the approval, and periodic applicant reports to DOER can be required

for operating parameters DOER considers related to the GHG benefits. The applicant would have a legal obligation under the regulations to certify the reports as accurate (subject to legal penalties if not). And DOER could have the right to audit the plant records at any time.

Similar to the tried and true process used by MA DEP for its air, water withdrawal, water discharge and other major permits, the approach of specifying a methodology for the applicant to use in his submittal will provide a fair process and will allow DOER to specify an appropriate time frame (we suggest 90 days following submittal of an application) before authorizing an RPS qualification for any specific plant.

Manomet did not provide an assumption for methane emissions from non-forest biomass. The methane emissions assumption applies mainly to non-forest biomass and could vary during operation depending on the fuel mix a CHP or all-electric plant uses. Therefore, it will be difficult in advance to definitively nail down the non-forest biomass fuel component. While it may be small for some CHP plants it will always be a substantial amount for a large CHP or all-electric biomass plant. **To eliminate any potential controversy over the methane emissions assumption (which must be set at some value other than zero) DOER may want to specify a minimum default percent methane emissions amount unless the RPS applicant can clearly demonstrate otherwise:**

- 2 percent of emitted carbons for forest biomass
- 12 percent of emitted carbons for non-forest biomass

The 12 percent assumption is defensible; it is perhaps half of what would apply to a waste-wood-fired plant. Both the Pacific Institute 2008 study (attached) and the NREL GHG studies indicate that methane landfill emissions from waste wood are in the 20-25 percent range, ranging from 50 percent in a landfill without methane collection systems to 14 percent in a landfill with a collection system, and less from other waste wood decomposition. The Pacific Institute study also points out that other biomass wastes and biomass that is incompletely combusted (e.g., fireplaces and wood stoves, open burning) emits some methane. Specifying the defensible default number of 12 percent will greatly simplify DOER's project review task. *In fact, a very simple solution may be to allow for a 12-percent methane default assumption for the entire fuel supply for any applicant. This would likely still understate the methane benefits for a large all-electric or CHP plant but may overstate the benefits for small to medium size CHP plants. Such a stimulus would be worthwhile for these CHP plants.*

Further, If the applicant in his submittal to DOER chooses to assume a methane emissions percent higher than 12 percent then he must agree to a requirement to document with specific supplier information a minimum fuel mix portion of non-forest biomass (waste wood) – verified through each fuel delivery receipt during operation – and written into the RPS qualification document issued by DOER.

In our comments we have provided great emphasis and specific information regarding the significance of methane emissions to the calculation of GHG benefits. With its 21-times greater GHG impact than CO₂, methane has a major GHG impact; therefore, elimination of methane emissions by combusting waste wood in a biomass plant would provide a major GHG benefit. The incorporation of the methane benefit in the GHG benefits analysis is the single most important factor in estimating and meeting the GWSA GHG reduction goals from biomass power generation. **Accordingly, failure to properly incorporate an accurate methane impact assumption into the GHG benefits analysis will substantially underestimate the life cycle benefits of biomass plants and the GHG reduction in support of the GWSA goal.**

Overall Reflections

We finish with some statements that reflect on the energy policy implications of the upcoming DOER RPS regulations.

- **In setting the efficiency, GHG life cycle and other requirements for the GHG qualification methodology DOER can use two fundamentally different approaches.** The first is to develop detailed formulas and specific data requirements to cover as many electric and thermal output scenarios and wood supply mixes for each biomass technology as possible. The second is to establish a minimum GHG benefit requirement for a future target year, coupled with a requirement for an RPS applicant to reflect in his benefit calculation the parameters for his project design and location that determine the GHG benefit. This second approach puts the burden on the applicant to provide verifiable information to DOER while allowing DOER to set the overall GHG benefit to be met. The second approach will be vastly more effective, simpler administratively, and less controversial than the first. It would be similar to the approach of setting plant output and environmental limit performance specifications for an EPC contractor, while letting him work out and provide the detailed design, including the maximum possible efficiency, intended to meet the performance output specs.

For the second approach DOER can provide the calculation methodology used by Manomet. A list of assumptions used in the Manomet carbon debt, recovery and dividend methodology can be provided, with an allowance for the applicant to use different assumptions if he can document the basis for them. A good example of this is the MA forest re-growth rate. A minimum methane emissions rate must be provided from sources other than Manomet. DOER would retain the authority to approve or not any assumption that is a departure from the Manomet assumptions. This is quite similar to the approach taken for the DEP air permit, which specifies the methodology for the air quality impact analysis that must meet specific air quality limits. The DEP air permit staff typically spends a lot of time reviewing the technology design and assumptions in reaching its determination that the plant will, in fact, meet the limits. DEP also specifies initial testing and operating report requirements to verify the applicant design (e.g., for DOER the wood supply source verification).

- **If there is a way to assure that biomass with better GHG benefits than coal under the GWSA 2050 goal is qualified, then DOER should strive to assure that.** The broader environmental impact comparison of biomass against coal power is so compelling (see the attached list of hazards associated with coal) that any energy policy official should use all means available – including the best possible interpretation of the July 7 letter – to assure biomass over coal. The broader energy policy and scientific community will likely react with great concern over an RPS GHG requirement that fails to assure this.
- **DOER should carefully document the basis for the specific provisions for the revised regulations and why, if applicable, DOER rejected a comment or recommendation that is not in dispute.** It is worth pointing out a prime example of this: the requirement for some methane emissions assumption because of the significant effect methane decay has on GHG impacts. That methane has such impacts is not contested by biomass proponents or opponents; it is the percent of methane emissions that could be disputed. As long as DOER provides for some minimum methane emissions in its methodology then it will have at least addressed this parameter.
- **It is critical that the revised regulations be science-supported.** The Bowles July 7 letter immediately references the 2008 MA GWSA in the first paragraph and makes clear in the second paragraph that new science provided by the Manomet study should guide the regulations. The Secretary is on target. It makes sense for the Manomet study results to guide the implementation of the GWSA. The one requirement in the Secretary's July 7 letter that, by itself, is not supported by any result of the Manomet study or any other scientific source is the "50 percent better than gas-fired power 20-year life cycle benefit" requirement. Interpreted incorrectly, it would almost certainly reduce the

2050 GWSA benefits that could be achieved. Based on the Manomet study results for tops and limbs used as fuel, biomass technologies that can best utilize non-forest biomass sources other than green wood chips will likely meet this requirement. This tends to favor all-electric plants and any large CHP plants with more sophisticated fuel handling systems, and would tend to constrain many, generally smaller CHP plants that require very uniform green wood chips and that cannot handle much of the waste wood that would be land-filled and emit methane. Given the entire range of language (in legal terms the “four corners of the agreement”) of the July 7 letter – which biomass opponents agreed to - it is a legitimate position for DOER to interpret the intent of this requirement as maximizing achievement of the long-term GWSA goals, and to avoid counterproductive short-term requirements that serve to reduce long-term benefits.